

**Appendix B**  
**Summary of major ASR projects in Washington**

---

## Appendix B: Summary of major ASR projects in Washington

---

### Cities of Kennewick and Richland

Together, the cities of Kennewick and Richland are evaluating the feasibility of ASR as part of an overall water resources plan to meet future water supply needs. Part of the plan would use Richland's existing Willowbrook well, which has mostly been used as an emergency backup when the city's primary water sources have experienced elevated temperatures.

Groundwater from the Willowbrook well contains hydrogen sulfide and methane that cause taste and odor problems. Due to these water quality conditions, Kennewick and Richland would like to determine whether ASR can improve well water quality and allow the cities to use the well more often without customer complaints.

Under the ASR proposal, Columbia River water from the cities' treatment plants would be recharged into the Wanapum Basalt aquifer using the Willowbrook well. The length of the storage period as well as the percentage of recharged water recovered would vary, depending on the hydraulic properties of the aquifer, the physical and chemical changes to the water during storage, and the length of demand.

The overall objective would be to design a reliable system to maximize the recovery of recharge water while providing consistent water quality to the municipalities' customers. Development of the Richland ASR appears to be feasible, based on an evaluation of new and existing information provided the Willowbrook well:

- Is completed in a moderately transmissive portion of a basalt aquifer that cannot impact surface water.
- Meets state well construction standards and is equipped with a pump that can be easily modified for ASR operations.
- Is connected with the city of Richland distribution system so recharge water can be easily conveyed to the well.
- Does not seriously affect the few major users of groundwater from the basalt aquifer in the vicinity of the well.

However, there are also some factors that need to be addressed before the Richland ASR can move forward. These include:

- Groundwater temperatures need to be high enough.
- Detectable levels of methane and hydrogen sulfide need to be low enough.
- The presence of disinfection byproducts in the recharge water, sometimes at levels higher than current state water quality (anti-degradation) standards, needs to be addressed.

**Permitting status** — The feasibility study was just completed and the cities have yet to submit any applications for reservoir and secondary permits.

## **Lakehaven Utility District**

The Lakehaven Utility District, located in Federal Way, has one operational ASR well that has been used as a pilot since 1991. The district is planning additional ASR wells as part of their Optimization of Aquifer Storage for Increase Supply (OASIS) project. The Federal Way area, like nearly all Western Washington, receives most of its precipitation between October and April when water demand is relatively low. The OASIS project is intended to operate seasonally, storing excess winter water from either ground or surface water sources and making it available between May and September when customer demand is at its peak and regional precipitation at its lowest.

Currently, the district's source water comes from the Redondo-Milton Channel aquifer which lies above the Mirror Lake storage aquifer. The shallower aquifer provides natural recharge to the storage aquifer and is more susceptible to variations in seasonal precipitation. During wet years, excess water from the channel aquifer recharges the storage aquifer. In drier years, the channel aquifer is supplemented with water from the Mirror Lake aquifer.

In the future, excess winter surface water will be available as recharge to the storage aquifer, allowing the storage aquifer to supplement high and higher summer demands both locally and regionally. The source of the winter recharge water would come primarily from the Green and Cedar rivers.

The Mirror Lake aquifer has an estimated usable storage volume of 29,000 acre-feet. It consists primarily of coarse sand and gravels with aquitards above and below the aquifer. Wells have been screened from approximately 100 feet above sea level to about 200 below sea level with an average screen length of around 60 feet. The raw water quality meets both primary and secondary drinking-water standards.

There are currently three wells in the storage aquifer. Two wells provide recovery while the third is a dual-purpose recharge and production well. In the future, as many as 27 wells are contemplated. Past operational tests, using groundwater as the source water, have not included pre- or post-treatment. However, if surface water is used, it is expected that pre- and post-treatment will be required.

**Permitting status** — No action has yet been taken on the district's application. Lakehaven Utility District applied to Ecology for reservoir and secondary permits shortly after E2SHB-2867 became law, primarily to secure a place in the permitting line. The district continues testing for the project.

## **Small-scale ASR in Redmond**

An electronics firm in the city of Redmond is constructing a data facility designed to withstand and remain in operation after a major earthquake. As part of its requirements, the facility will need a reliable source of emergency cooling water at a maximum sustained rate of 175 gallons per minute until its normal connection with the city of Redmond can be re-established. The maximum design stored volume for a 50-day supply is approximately 10 million gallons.

The firm is evaluating the feasibility of using a small-scale ASR system to provide a reliable supply of emergency cooling water for the facility. ASR is being considered for the following reasons:

- Well technology has been shown to be reliable in large-magnitude earthquakes, particularly if a facility's power and piping are designed for the event.
- The likelihood of obtaining a new groundwater right in the known aquifers is low due to the over-appropriation and potential surface water-ground water interconnection issues in the area.
- The availability of an existing water right for purchase is uncertain and appears to be unlikely.

Even though ASR is envisioned as primarily for emergency supply, an annual operational cycle is proposed for the system to provide the following benefits:

- Annual exercise of the system to ensure operational reliability.
- Use of the ASR system for facility cooling water during peak usage times in the summer to provide relief to the regional water supply.
- Replenishment of the stored water "bubble" after migration during storage periods.

The key feasibility factors to be addressed in 2002 include obtaining a commitment on the part of water purveyors to provide source water for the facility and for ASR injection, determining the permitting requirements for the project, and drilling a test well to verify the presence of a separate deeper aquifer that can accommodate the desired ASR system.

**Permitting status** — As the summary indicates, this project is still in its early stages of development. Project proponents have not submitted any applications to Ecology at this time.

## **Seattle Public Utilities**

During the 1980s, the Seattle Water Department, now called Seattle Public Utilities, developed and put the Highline well field in service. The well field consists of three production wells capable of delivering a total of 10 million gallons per day. The well field has two basic uses:

- A peaking source that could be started in July and run for up to four months.
- An emergency supply.

In the early 1990s, Seattle Public Utilities received a grant from the U.S. Bureau of Reclamation to study artificial recharge as a means to enhance its Highline well field productivity. Artificial recharge of the aquifer with treated drinking water from the utility's Cedar River source was found to be feasible.

Two production wells are configured so water can be dropped by gravity down the space between the well casing and the pump column and out through the well screen into the aquifer. The ASR study found that artificial recharge in the Highline well field will not increase production capacity significantly above the current 10 million gallons per day. However, its use following heavy pumping of the well field will hasten the return of the aquifer to pre-pumping conditions. Seattle utility operators currently favor the use of its Cedar and South Fork Tolt

surface water sources, so the Highline well field has been used only sparingly in recent years and augmentation of the natural recharge to the aquifer has not been needed. Even so, it is considered a viable technique that should be “on call” for future well field operations.

**Permitting status:** Seattle has operated its Highline well field ASR project for several years under a series of temporary permits issued by Ecology. In 2001, Ecology sought to update the permitting status of the project but was advised by counsel to ensure that Seattle complied with the terms and conditions of the new legislation before proceeding.

## **City of Walla Walla**

The city of Walla Walla’s ASR program, implemented in 1999, is the lynchpin for the city's long-term water supply planning efforts. The program has shown that recharged water can replenish portions of the region’s deep basalt aquifers. In addition to seeing aquifer water levels rise, program has also sparked a dialogue with other deep basalt water-right holders in the area regarding regional planning for groundwater use.

Walla Walla’s ASR program may also prove a key tool in the city's fire fighting arsenal. Recently, the U.S. Forest Service notified the city that the 36-square mile Mill Creek Watershed is at risk for a catastrophic fire because of the buildup of combustible materials. Should a catastrophic fire erupt in the watershed, turbidity levels in Mill Creek would rise above state and federal standards. Since the city is served by an unfiltered water supply, Walla Walla would no longer be able to divert Mill Creek water for a substantial period of time. An aggressive ASR program would provide the resources and ability to counter the loss of surface water supplies with stored ASR reserves.

Currently Walla Walla’s single ASR well has the capability of recharging 150-200 million gallons per year. In 2002, the city hopes to bring another ASR well on line. If the rules are finalized by that time and no new water right is required, the city would like to drill a new well which would replace the need for a large, expensive above-grade storage tank needed to supplement low pressures during the summer.

An expanded ASR program in Walla Walla will also likely have another benefit for the community and the environment. During the 2001 drought, the city was approached by the National Marine Fisheries Service to participate in an experiment to increase survivability of Endangered Species Act-listed steelhead in Mill Creek. The city voluntarily returned a portion of its appropriated surface water flow to Mill Creek and offset this loss by pumping back the balance into the distribution system using its ASR water.

**Permitting status:** Walla Walla has conducted the pilot test of its ASR project under a water right issued by the state of Oregon. The city intends to eventually operate its ASR project under an inchoate Washington water right permit. However, because the actual diversion of water under that permit would take place within the state of Oregon, some legal issues need to be resolved before that water right permit can be used. To date, Walla Walla has not submitted any applications for reservoir or secondary permits to Ecology.

## City of Yakima

The city of Yakima commissioned a pilot test to determine the feasibility of an ASR project in the Ahtanum-Moxee sub-basin in the central part of the Yakima Basin. A pilot test conducted during the fall and winter of 2000-01 indicates that a full-scale ASR program would be both hydrogeologically and operationally feasible.

The primary source of the ASR water is the city's Naches River Rowe Hill Water Treatment Plant. The recharge well was the city's Kissel well, which is screened between 876 and 1,163 feet below ground surface, in the Lower and Middle Members of the Upper Ellensburg Formation.

Recharge to the Kissel well was conducted for 25 days at a rate of approximately 1,200 gallons per minute. A total of 45.2 million gallons was recharged. After a storage period of 55 days, recovery was conducted at a constant pumping rate of approximately 2,000 gallons per minute for 30 days. A total of 89.7 million gallons was withdrawn as part of the test, the additional amount withdrawn to ensure that there were no residual disinfection byproducts. Additional water was removed during post-pilot test step tests. Water for the pilot test was delivered through the existing municipal water supply system of the city of Yakima. The distribution system operated without disruption of public service.

Recharge activities resulted in an estimated sustained rise of about six feet in the water levels of the Ellensburg Formation at the Kissel well for the two-month storage period.

Water quality monitoring indicated compliance with state drinking water standards. Although disinfection byproduct (DBP) concentrations did increase temporarily during storage before decreasing, DBP concentrations remained well below drinking water standards at all times. Based on the results of tracer analyses, it is estimated that approximately 70 percent of the water recharged to the aquifer was recovered. The remainder of the water presumably remained in the aquifer and contributed to the net storage of the hydrologic system.

A full-scale ASR program using the city of Yakima's available infrastructure is also operationally feasible. However, to increase the capacity of the groundwater supply system, additional wells would have to be installed. The permitting of these withdrawals should be easier if they are operated as part of an ASR program. Key regulatory components include:

- How ASR operations using chlorinated potable water containing disinfection byproducts will be addressed under water quality standards for groundwater.
- The means of quantifying the permitted amount of water that may be recovered following recharge.

**Permitting status** — While Yakima and its consultant have engaged in discussions with Ecology, the city has yet to submit applications for reservoir and secondary permits. Ecology did issue the city temporary permits to conduct the pilot test.